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13. ABSTRACT  Describes a method for evaluation of heating equipment operational and performance characteristics. Identifies supporting tests, facilities, and equipment required. Provides procedures for heating capacity and smoke tests. Applicable to space, radiant, portable nonduct and duct type heaters.			

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U.S. ARMY TEST AND EVALUATION COMMAND  
SYSTEM ENGINEERING TEST OPERATIONS PROCEDURES

AMSTE-RP-702-109

\*Test Operations Procedure 10-2-072

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HEATING EQUIPMENT

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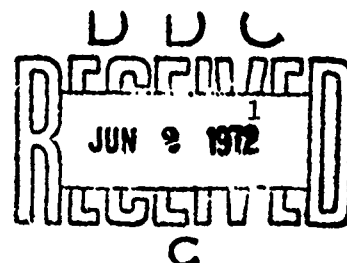
SECTION I  
GENERAL

1. Purpose and Scope. This TOP describes test procedures for evaluating the operational and performance characteristics of heating equipment. Equipment covered includes: space, radiant, portable nonduct and duct type heaters. From the tests listed in Section II, the test director can select those that will satisfy the requirements for the particular test item and the particular test type (i.e., engineering test, initial production test, etc.). Test objectives are to determine conformance of the test items to QMR, MN or other suitability criteria. For initial production tests, scope will be in accordance with the contractual provisions of the applicable military specifications and suitability criteria established by the test directive. This document provides for simulated environmental testing but does not include service testing or environmental testing at climatic test sites.

2. Background. The requirement of nonduct heaters to support field operations of the Armed Services entail a variety of problems and a continuing challenge in research. To fulfill these heater requirements, new types of heaters are constantly being developed and the existing heaters are being improved or modified to support the military requirements brought about by the new tactical and logistical concepts of

\*This TOP supersedes MTPs 10-2-070 (24 Jul 67), and 10-2-071 (21 Mar 68), including all changes.

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warfare. These new and improved heaters then are the results of projects to correct deficiencies, to improve upon operation, and to reduce cost without changing general operational characteristics. The heaters must be capable of efficiently performing their required function in the field for which they have been developed or modified.

3. Equipment and Facilities. Equipment and facilities required are defined in the documents listed in Section II and Section III.

## SECTION II TEST PROCEDURES

4. Supporting Tests. Subtests (generally in preferred order of completion with respect to high-risk, short duration) to be considered in formulating a test plan are listed below with references.

<u>TEST SUBJECT TITLE</u>	<u>PUBLICATION NO.</u>
a. Pre-operational Inspection	10-3-500
(1) Operator Training and Familiarization	10-2-501
(2) Photographic Coverage	7-3-519
b. Physical Characteristics	10-2-500
c. Safety	10-2-508
d. Performance	
(1) Coal Fired Space Heater	MIL-H-11219B Para 4.2
(a) Capacity (Refer to para 5)	
(b) Smoke Test (Refer to para 6)	
(2) Electric Space Heater	MIL-H-19910 Paras 4.5.2, 4.5.3
(a) Capacity (Refer to para 5)	
(b) Multifuel Space Heater	MIL-H-52204B Paras 4.5.2.4, 4.5.2.6, 4.5.2.8
(a) Capacity and Airflow	Para 4.5.2.1
(b) Controls and Safety Operation	Para 4.5.2.3
(4) Duct Heaters	MIL-H-52230A Paras 4.5.2.6, 4.5.2.8, 4.5.2.10
(a) Capacity and Airflow	Para 4.5.2.1
(b) Controls and Safety Operation	Para 4.5.2.3

TEST	WHITE SECTION <input checked="" type="checkbox"/>
DUC	BUFF SECTION <input type="checkbox"/>
UNAPPROVED	<input type="checkbox"/>
JUSTIFICATION	
RECOMMENDATION/REMARKS	
DATE	
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	<u>TEST SUBJECT TITLE</u>	<u>PUBLICATION NO.</u>
e.	Environmental Testing	
(1)	Altitude	MIL-STD-810B Method 500
(2)	Temperature	Method 501
(3)	Sunshine	4-2-826
(4)	Rain	2-2-815
(5)	Humidity	4-2-820
(6)	Fungus	4-2-818
(7)	Salt Fog	MIL-STD-810B Method 509
(8)	Dust Test	Method 510
(9)	Vibration	4-2-804
		MIL-H-52230A Para 4.5.2.2.7
(10)	Rough Handling Shock	4-2-602 MIL-H-52204B Para 4.5.2.2.7
(11)	Electromagnetic Interference Characteristics	MIL-STD-461A Notice 4 MIL-STD-462 Notice 3 Methods CE02, RE05
f.	Transportability	
(1)	Road, Rail, Marine	10-2-503
(2)	Air	7-2-515
g.	Human Factors Evaluation	10-2-505
	Sound-level	
(1)	Space Heater	MIL-H-52204B Para 4.5.2.5
(2)	Duct Heater	MIL-H-52230A Para 4.5.2.5
h.	Reliability	AMCP 702-3
	Confidence Intervals and Sampling Size	3-1-002
i.	Durability (Endurance Testing)	10-2-502
j.	Maintenance Evaluation	10-2-507
k.	Value Analysis	USAMC SUPPL 1 to AR 11-26

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SECTION III  
SUPPLEMENTARY INSTRUCTIONS

5. Capacity.

a. Objective. To determine the heating characteristics of the test item.

b. Method. The test item is mounted or installed in the center of the test area. Thermocouples or mercury thermometers are positioned about the test item as shown in figure 1. The test item is then operated for one hour at test conditions to insure temperature stabilization and uniform operation. After stabilization, the required data is recorded every 15 minutes for a total of not less than five complete sets of data. These procedures are repeated for test item operating conditions of one-quarter, one-half, three-quarters and maximum output.

c. Data Required.

- (1) Test item nomenclature and type.
- (2) Temperature recorded at the installed thermocouples or thermometers.
- (3) Fuel weight in pounds and ounces or power input in volts, watts and amps used during recorded test periods.
- (4) Flue-gas temperature, °F (read within one inch of where flue-gas analysis sample is taken), if applicable.
- (5) Flue-gas analysis, if applicable (refer to paragraph 4.5.2.1.6, MIL-H-52204B (appendix)).

d. Analytical Plan. The indicated and measured outputs and efficiencies are computed and compared with the requirements of the MN to determine conformance to specifications.

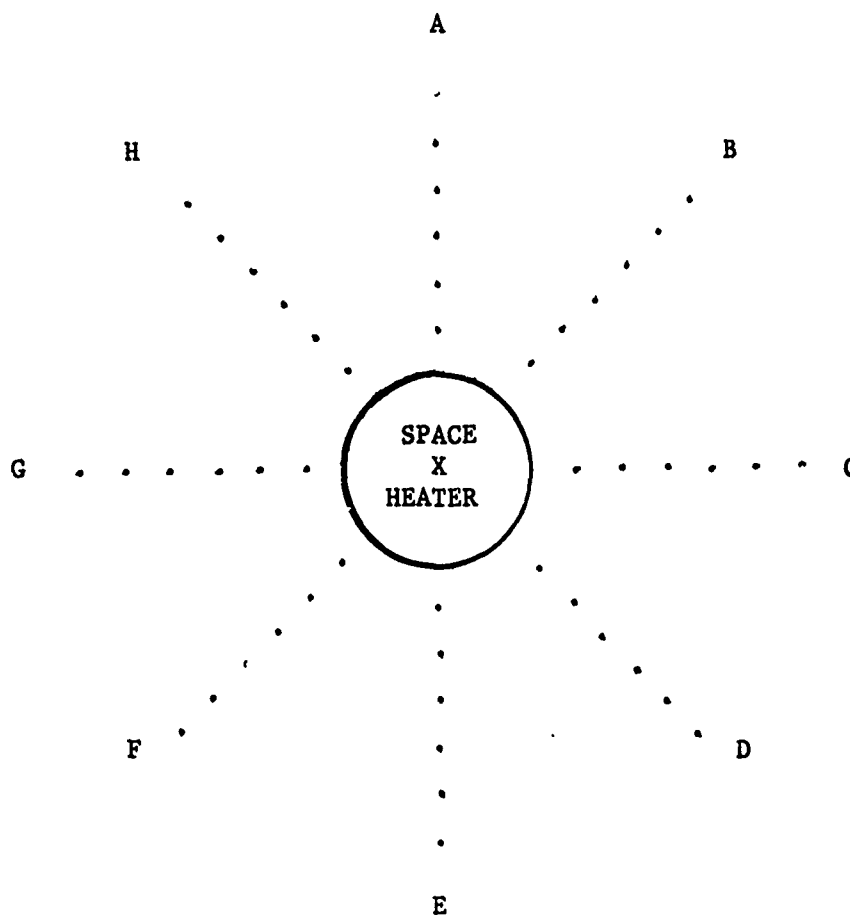
6. Smoke Test.

a. Objective. To determine that the test item does not emit smoke which is hazardous to health and welfare of personnel.

b. Method. A sample of gases emitted from the test item is collected and subjected to a laboratory analysis to determine its content. Photographs are taken of any visible gas emissions (smoke).

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- NOTE:
1. Each dot represents an increment/measurement at which a thermocouple or thermometer will be installed away from the heater.
  2. "X" is the thermocouple in the flue, when applicable.
  3. Drawing is not to scale.

Figure 1. Example of Arrangement of Thermocouples or Thermometers.

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c. Data Required.

- (1) Test item nomenclature and type.
- (2) Volume of gas sample.
- (3) Photographs of visible gas emissions (smoke).
- (4) Laboratory analysis of gas sample.

d. Analytical Plan. The contents of the analyzed gas sample and the photography of the visible gas emissions are compared with the requirements of the MN to determine conformance to specifications.

Recommended changes to this publication should be forwarded to Commanding General, U.S. Army Test and Evaluation Command, ATTN: AMSTE-ME Aberdeen Proving Ground, Maryland 21005. Technical information related to this publication may be obtained from the preparing activity, Commanding Officer, Aberdeen Proving Ground, ATTN: STEAP-MT-DM, Aberdeen Proving Ground, Maryland 21005. Additional copies of this document are available from the Defense Documentation Center, Cameron Station, Alexandria, Virginia 22314. This document is identified by the accession number (AD No.) printed on the first page.



APPENDIX  
REFERENCES

1. AR 70-38, "Research, Development Test, and Evaluation of Materiels for Extreme Climatic Conditions."
2. USAMC Supplement 1 to AR 11-26, "Value Engineering."
3. AMCP 702-3, "Quality Assurance - Reliability Handbook."
4. MIL-STD-461A, "Electromagnetic Interference Characteristics, Requirements for Equipment", including notices 1 thru 4.
5. MIL-STD-462, "Electromagnetic Interference Characteristics, Measurement of", including notices 1 thru 3.
6. MIL-STD-810B, "Environmental Test Methods", including notices 1 thru 4.
7. MIL-H-11219B, "Heater, Space, Non-Electric (Magazine Type, Coal-Fired, 50,000 BTU Per Hour)."
8. MIL-H-19910, "Heater, Space, Electric."
9. MIL-H-52204B, "Heaters, Space; Multi Fuel, With Blower, 15,000 BTU/Hr."
10. MIL-H-52230A, "Heaters, Duct-Type, Portable: 150,000 BTU/Hr."